

Study Guide

For use with pages 63–68

GOAL Use properties of addition and multiplication.**VOCABULARY****Commutative Property of Addition:** In a sum, you can add the numbers in any order.**Associative Property of Addition:** Changing the grouping of the numbers in a sum does not change the sum.**Commutative Property of Multiplication:** In a product, you can multiply the numbers in any order.**Associative Property of Multiplication:** Changing the grouping of the numbers in a product does not change the product.**Identity Property of Addition:** The sum of a number and the **additive identity**, 0, is the number.**Identity Property of Multiplication:** The product of a number and the **multiplicative identity**, 1, is the number.**EXAMPLE 1** Using Properties of Addition

You listened to your radio for 27 minutes on Monday, 9 minutes on Tuesday, and 13 minutes on Wednesday. Find the total time you spent listening to your radio.

Solution

The total time is the sum of the three times. Use properties of addition to group together times that are easy to add mentally.

$$\begin{aligned}
 27 + 9 + 13 &= (27 + 9) + 13 && \text{Use order of operations.} \\
 &= (9 + 27) + 13 && \text{Commutative property of addition} \\
 &= 9 + (27 + 13) && \text{Associative property of addition} \\
 &= 9 + 40 && \text{Add 27 and 13.} \\
 &= 49 && \text{Add 9 and 40.}
 \end{aligned}$$

Answer: The total time is 49 minutes.

EXAMPLE 2 Using Properties of Multiplication

Evaluate $2xy$ when $x = 8$ and $y = -35$.

$$\begin{aligned}
 2xy &= 2(8)(-35) && \text{Substitute 8 for } x \text{ and } -35 \text{ for } y. \\
 &= [2(8)](-35) && \text{Use order of operations.} \\
 &= [8(2)](-35) && \text{Commutative property of multiplication} \\
 &= 8[2(-35)] && \text{Associative property of multiplication} \\
 &= 8(-70) && \text{Multiply 2 and } -35. \\
 &= -560 && \text{Multiply 8 and } -70.
 \end{aligned}$$

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Exercises for Examples 1 and 2

Evaluate the expression. Justify each of your steps.

1. $64 + 15 + 6$

2. $34 + 75 + 26$

3. $48 + 36 + 22$

4. Evaluate $15xy$ when $x = 9$ and $y = 2$.

EXAMPLE 3**Using Properties to Simplify Variable Expressions**

Simplify the expression.

$$\begin{aligned}
 21 + 3(8y) + 30 &= 21 + (3 \cdot 8)y + 30 \\
 &= 21 + 24y + 30 \\
 &= (21 + 24y) + 30 \\
 &= (24y + 21) + 30 \\
 &= 24y + (21 + 30) \\
 &= 24y + 51
 \end{aligned}$$

Associative property of multiplication

Multiply 3 and 8.

Use order of operations.

Commutative property of addition

Associative property of addition

Add 21 and 30.

Exercises for Example 3

Simplify the expression.

5. $-8 + x + 3$

6. $3(21x)$

EXAMPLE 4**Multiplying by a Conversion Factor**

The African Elephant is the largest living land animal. Its average weight is 6 tons. What is the African Elephant's average weight in pounds?

Solution

- (1) Find a conversion factor that converts tons to pounds. The statement $1 \text{ ton} = 2000 \text{ pounds}$ gives you two conversion factors.

Unit analysis shows that a conversion factor that converts tons to pounds has pounds in the numerator and tons in the denominator:

$$\cancel{\text{tons}} \cdot \frac{\text{pounds}}{\cancel{\text{tons}}} = \text{pounds}$$

- (2) Multiply the African Elephant's weight by the conversion factor from Step 1.

$$6 \text{ tons} = 6 \cancel{\text{tons}} \cdot \frac{2000 \text{ pounds}}{1 \cancel{\text{ton}}} = 12,000 \text{ pounds}$$

Answer: The average weight of the African Elephant is 12,000 pounds.

Exercise for Example 4

7. Use a conversion factor to convert 3 years to months.